DECLARATION OF DR. KANWALJEET S. ANAND

I am Dr. Kanwaljeet S. Anand, M.B.B.S., D.Phil., FAAP, FCCM, FRCPCH who files this declaration under penalty of perjury. I am a pediatrician specialized in the care of critically ill newborns and children. I serve as a fully tenured Professor of Pediatrics, Anesthesiology, Perioperative & Pain Medicine at Stanford University School of Medicine, and as Director of the Pain/Stress Neurobiology Laboratory at Children's Hospital Research Institute. For more than 30 years, I have conducted intensive research and study on the development of pain/stress in human newborns, their development during early childhood, and long-term outcomes. I have authored 311 scientific publications (125 in the last 10 years), edited 9 books, and received numerous professional awards. My true and correct Curriculum Vitae is attached. I am personally familiar with Opioid Use Disorder in pregnancy and Neonatal Abstinence Syndrome and have reviewed all materials referenced below.

Recognizing the present state of the Opioid Crisis in America, a medical emergency has been declared by the President of the United States. This emergency is particularly acute in its effects on *in utero* babies from conception through their lives. I offer the following statements for the Court's consideration:

Definitions

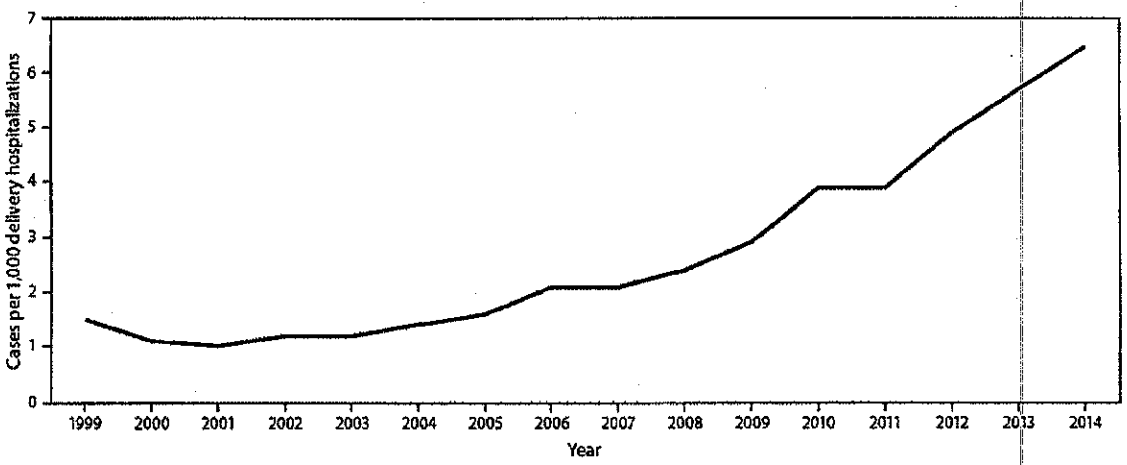
- Opioid Use Disorder (OUD) is defined in the DSM-5 as a problematic pattern of opioid use leading to clinically significant impairment or distress. OUD was previously classified as Opioid Abuse or Opioid Dependence in DSM-IV. OUD has also been referred to as "opioid addiction."
- Neonatal abstinence syndrome (NAS) is a group of problems that occur in a newborn who was exposed repeatedly to opiate drugs while in the mother's womb.

The numbers of babies reported to be born with OUD annually

1) Based on trend analyses for Opioid Use Disorder (OUD) in pregnancy, approximately 36,000 of babies are likely to be born with NAS in 2018[1] (projected using the CDC birth rate data)[2-4]. CDC data released recently show that the documented rate for OUD was 6.5 per 1,000 delivery hospitalizations in 2014 (MMWR, August 2018[1]). This is a very conservative estimate, since it does not include babies delivered at home, at maternity clinics, or birthing centers. Epidemiological studies show that rates of OUD may be higher among women who generally use non-hospital birthing centers or prefer delivering their baby at home[1,5-7].

   Using recently published trends from 1999 to 2014[1], the National Average Annual increase in OUD rates was 0.39 per 1,000 delivery hospitalizations per year. This is a conservative estimate, since it averages out the increases in OUD rates over 16 years of collected data, whereas the rate of increase has been much greater in the past 5 years (see Figure 1).

FIGURE 1. National prevalence of opioid use disorder per 1,000 delivery hospitalizations* — National Inpatient Sample (NIS),† Healthcare Cost and Utilization Project (HCUP), United States, 1999–2014



Even using this conservative yearly rate increase (3.9%) will give us OUD rates increasing up to 8.45 per 1,000 delivery hospitalizations in 2019. However, if we project the OUD rate increases from the past 5 years, National Average increases show an increased rate of 7.2% or 0.72 per 1,000 delivery hospitalizations per year. This will give us OUD rates increasing to 10.1 per 1,000 delivery hospitalizations in 2019. These data are listed in **Table 2** below.

In addition, however, **Table 2** also includes the "corrected" OUD rates after adjusting for:

(1) women undergoing detox before the baby's birth, whose babies may not show signs of NAS; and (2) those women who do not deliver in a hospital (previous studies have reported higher OUD rates among these women).

Table 1: Calculated numbers of Newborn Babies with NAS: Trend analyses from 2014 to 2019

	National Average Increase 0.39/year (using 1999-2014 data)			National Average Increase 0.72/year (using 2011-2014 data)			Estimates including babies who detox *in utero* and those born in non-hospital settings		
	OUD rate/1000 hospital deliveries	Number of live-births: CDC data	Number newborns with NAS	OUD rate/1000 hospital deliveries	Number of live-births: CDC data	Newborns with NAS	Corrected OUD rates/1000 live births	Number of live-births: CDC data	Newborns with NAS
2014	6.5	3,988,076	25,922	6.5	3,988,076	25,922	7.5	3,988,076	29,911
2015	6.89	3,978,497	27,412	7.22	3,978,497	28,725	8.5	3,978,497	33,817
2016	7.28	3,945,875	28,726	7.94	3,945,875	31,330	9.4	3,945,875	37,091
2017	7.67	3,853,472	29,556	8.66	3,853,472	33,371	10.3	3,853,472	39,691

2018*	8.06	3,776,403	30,438	9.38	3,776,403	35,423	11.1	3,776,403	41,918
2019*	8.45	3,738,639	31,591	10.1	3,738,639	37,760	11.9	3,738,639	44,490

*2018 Number of Live-births estimated with a 2% decrease in births from 2017; *2019 Number of Live-births estimated with a 1% decrease in births from 2018

The true number of babies with NAS is estimated to be considerably higher given reporting requirements and babies who detox in utero.

2) The "corrected" numbers of babies with NAS are estimated to be considerably higher (about 42,000 babies in 2018; see **Table 1**) given the CDC reporting requirements; those babies who detox *in utero,* and those babies born in non-hospital settings are not included in the NAS data collected following hospital deliveries[6-9]. Proposed criteria for diagnosis of OUD in women who detox before delivery are listed in **Table 2** below.

Table 2: Proposed Criteria for Mothers with Opioid Use Disorder in Pregnancy (no OUD at delivery)

Inclusion Criteria: To qualify for a diagnosis of prescription drug OUD, patients should meet a minimum 3 of the 4 listed criteria
1. **Continuous opioid use** for 4 consecutive weeks or longer in pregnancy (confirmed via entries in her medical record, filled pharmacy prescriptions, and/or other sources of prescription opioids). 2. **Dose escalation** during opioid exposure by 100% (i.e., doubling of the original starting opioid dose) showing opioid tolerance during the period of opioid exposure. 3. **Addiction Severity Index** (6th Edition), showing clinically significant scores in 2 subscales, including the (a) Clinical Global Impression scale-Severity (CGI-S; score range 0-8) → cutoff score of 5 or greater; *and* (b) Drug Abuse Scale – Severity (DAS-S; score range 31-77) → cutoff score of 45 or higher. 4. **Evidence for NAS** in the baby within the first 72 hours after birth (modified Finnegan score ≥ 8 from two consecutive assessments performed by a qualified healthcare practitioner with a minimum interval of 4 hours between the two consecutive NAS assessments).
Exclusion Criteria: To qualify for a diagnosis of prescription drug OUD, these criteria must NOT be present:
1) Chronic pain disorder or chronic pain condition diagnosed by a qualified physician before or during the current pregnancy, OR 2) Major psychiatric disorder diagnosed by a psychiatrist in 1 year before or during the current pregnancy.

Annual growth rate

3) This number is growing annually at a rate of 3.9% averaged over the past 16 years (1999-2015), but the available data show that the average rates of increase in OUD have been much greater in the past 5 years. CDC states that NAS is "clearly underestimated and under-reported" but data available from 36 states as of 2015 showed approximate increases of 7.2% per year between 2011 and 2015[1,6-9]. It appears that the newer synthetic opioids (including methadone) have greater addictive properties.

Constellation of symptoms for OUD in pregnancy

4) Effects of OUD in pregnancy include: premature birth, spontaneous abortion, low birth weight, maternal-fetal effects, intrauterine growth retardation (IUGR), placental insufficiency, premature rupture of membranes, perinatal infections, postpartum hemorrhage, perinatal or neonatal mortality, increased birth defects, delayed cognitive development, long-term behavioral problems, ADHD, auditory deficits, speech delay, swallowing difficulty, gastro-esophageal reflux disease (GERD), digestive disorders, delayed feeding, failure to thrive, congenital neurological defects, and congenital heart defects[10-16].

Time periods of interventions to achieve the best outcomes

5) For most of these conditions, the best possible outcomes can only be achieved with proper management of the NAS, increased surveillance, and active multi-disciplinary interventions that are initiated immediately after birth and continued for the first 3-5 years (depending on the severity of prescription opioid exposure)[10,17-28].

Evidence suggesting that prenatal opioid exposure damages DNA

6) Huge amounts of published data substantiate the findings that opioid exposures alter genetic regulation and DNA structure, but many of these studies were performed in animal models[29]. Almost 40 years ago, however, leading researchers discovered that opioid addiction damages human DNA and/or prevents DNA repair occurring from other causes of DNA damage (e.g. UV light)[30]. Since then, accumulating data have shown the progressive effects of repetitive opioid exposure on DNA fragmentation occurring in the human brain and in peripheral blood cells[30-43]. More recently, several studies also documented the epigenetic effects of opioid addiction, capable of intergenerational and transgenerational transmission to the offspring of opioid addicts[44-52]. Although pregnant women were excluded from most of these studies, the underlying mechanisms are likely to have extensive effects on the massive DNA synthesis occurring during fetal development[38,53].

Consequent to the opioid effects on human DNA cited above, a large number of studies have found a higher incidence of birth defects in the babies exposed to maternal opioids *in utero*[16]. Seventeen (17) studies found opioid exposure linked with facial/oral defects (e.g., cleft lip, cleft palate, or others), heart defects (e.g., ventricular septal defects, atrial septal defects, hypoplastic left heart syndrome, pulmonary valve stenosis, conoventricular septal defects), limb deformities (e.g., clubfoot), visceral organ defects (e.g., gastroschisis), or neural tube defects (e.g., spina

bifida)[11,12,14-16]. Most of these conditions require multiple surgical operations and long-term medical care to support the optimal development of these severely affected children[14,54].

The *"social determinants of health"* are different in NAS babies

7) In addition to suffering medical diagnoses, the children of opioid addicted women are much more likely to be born into poverty, broken homes, placed into foster care, have addiction problems of their own, or seen by criminal justice system, etc. Nationally, about 40% go into foster care and child protective services. There were 92,100 children in foster care system in 2016 (US Department of Health and Human Services Adoption and Foster care Analysis and Reporting System, October 20, 2017). These findings are not unique to the US system. For example, from the 58 babies exposed to maternal buprenorphine in Finland, 11 infants (19%) were discharged home, 19 (33%) placed in foster care, 27 (48%) discharged to institutional care with their mothers and 1 infant followed her mother to prison[55]. Thus, the home/social environments of NAS babies are likely to be unpredictable, potentially unsafe and certainly not supportive of their early development without the appropriate maternal supports and long-term monitoring.

Long-term cognitive and behavioral outcomes of babies with NAS

8) Opioids have drastic and sustained effects on brain development in the fetal and postnatal periods, affecting the brain's size, architecture, numbers and connections of brain cells, neurochemical and other functions of each cell, as well as the brain DNA's structure, its expression and regulation. Opioids are expected to have robust and long-term effects on the cognitive and behavioral outcomes of babies with NAS (or those exposed to maternal opioids but without NAS at birth). Published follow-up studies of NAS babies, however, show minimal long-term effects related to prenatal opioid exposure. Baldacchino et al. identified 200 follow-up studies of opioid exposures during pregnancy, but only 8 studies met inclusion criteria with 4 studies in infancy, 3 assessing preschool children, and 1 on school children[56,57]. All these were retrospective case-control studies conducted within urbanized, low socioeconomic communities, with mothers exposed to either heroin or methadone (a synthetic opioid). Five studies had data usable for meta-analysis, with a total of 218 opioid-exposed and 205 non- exposed children. In all outcomes opioid-exposed children had lower scores as compared to controls[56].

A large number of studies have reported lower birth weights and smaller head circumferences in opioid-exposed babies[55,58-68]. A controlled comparison showed that reduced fetal head and body growth in infants of opioid-dependent mothers were not explained by gestational age, cigarette smoking, area deprivation, infant gender, maternal age or parity[69]. Given the limited maternal/environmental effects on head circumference, it is likely that the robust effects of opioid exposure on head circumference occur by reducing brain growth[54,70]. This was confirmed in a pilot study of 16 infants, where volumetric MRI scans showed smaller whole brain volumes and basal ganglia volumes compared to age-matched population means[59]. In another follow-up MRI study that included 38 youths in the opioid-exposed group and 44 youths in the non-exposed group (aged 17 to 22 years), the drug-exposed group displayed smaller neuroanatomical volumes (difference in total brain volume, $p=0.001$), smaller surface areas of the cerebral cortex, and thinner cortical mantle than the comparison group[71].

The consequences of this impaired brain growth are also pervasive, with altered dyadic interactions of mothers and infants[72], impaired neurodevelopment at 6 months in all domains of Griffith's Mental Development Scales[73], impaired visual acuity and visuomotor functions[70,73,74], impaired language-related cognitive skills and executive functions[75,76], with inattention, hyperactivity, impulsivity, aggression, ADHD and other behavioral problems persisting into adolescence and even adulthood in those born to opioid-dependent mothers during pregnancy[58,71,77-79]. The long-term opioid effects on cognition tended to increase rather than wane over time, even in adoptive/foster children with fewer postnatal risks[77].

Thus, there is an urgent imperative for documenting the longer-term outcomes of children exposed to opioids in pregnancy, through well-designed studies that prospectively enroll pregnant women using prescription opioids (with or without OUD) and consistently follow their children into the teenage years with good retention rates.

Large knowledge gaps exist in the management, interventions, and monitoring of pregnant women with OUD and their infants

9) Experts from the National Institute of Child Health & Human Development (NICHD), Centers for Disease Control & Prevention (CDC), American College of Obstetrics & Gynecology (ACOG), American Academy of Pediatrics (AAP), Society for Maternal-Fetal Medicine, and the March of Dimes (MOD) convened in April 2016 to discuss OUD in pregnancy and its outcomes[80]. They summarized the current knowledge in this area and noted 35 major areas where scientific evidence is lacking or unreliable. These knowledge gaps, listed in Table 3 below, have largely remained unfilled in the time since this report was published (July 2017).

Table 3: Gaps in Scientific Knowledge (adapted from Box 4 of the Executive Summary, Reddy et al.[80])

Clinical Research	Unanswered Questions
Prenatal Care	What are the best approaches of screening pregnant women for OUD?
	How do we maintain patient confidentiality and trust while minimizing judgmental behavior, punitive implications, and maternal anxieties regarding child custody and social stigma?
	How can we structure comprehensive prenatal care to bring all available resources to women?
	What are the best methods and frequency for assessments of fetal well-being?
Medication-Assisted Therapy & Detoxification	What are the most effective practices for engaging pregnant women into treatment programs? • Include women recovering from opioid use disorders? • Develop screening tools to predict the probability of relapse • Use physiologic measures of opioid withdrawal rather than simply assessing cravings?
	What are the best treatment approaches for medication-assisted therapy (MAT) or detox during pregnancy, ensuring optimal safety, efficacy, and minimal relapse?
	Can "precision medicine" inform the appropriate dosing for medications throughout pregnancy? Postpartum?

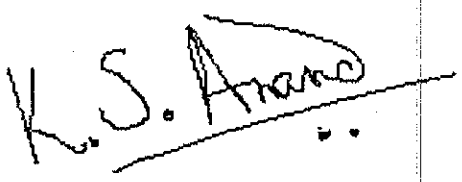
	During breastfeeding? Which opioid works best for which patients? Need pharmacokinetic and pharmacodynamic data for opioids during pregnancy and breastfeeding (e.g., fast vs. slow metabolizers may need different dosing schedules).
	For how long do patients need the medication-assisted therapy? What are the best ways for weaning or detox? Should weaning be performed during or after pregnancy? How can we prevent OUD in future pregnancies?
	Are there subgroups of women with OUD who will be successful with detoxification therapy (avoiding MAT)? → Need evidence for optimal fetal assessment and efficacy, role of benzodiazepines and adjunctive medications, medical interventions for detox complications, excellent follow-up of women/children following detox. How can we anticipate and minimize potential relapse rates if detoxification is undertaken?
	What is the pathophysiology of detoxification during pregnancy, in terms of maternal, utero-placental function, and fetal effects?
Labor & Delivery	What is the optimal and appropriate dosing for opioid and non-opioid analgesia/anesthesia during labor & delivery? What are the patient factors that modify these drug effects (e.g., polydrug use, smoking, and stress)?
	What is the comparative effectiveness of non-opioid alternatives for post-Cesarean pain control (e.g., gabapentin, transversus abdominis plane block, intravenous acetaminophen)? How can we educate and change physician practices to improve postpartum pain management? What is the risk of overdose in those using illicit opioids or on high-dose medication-assisted therapy for OUD? Is pregnancy an independent risk factor for opioid overdose? If so, is it mediated by sleep apnea/dysregulation? How can we align the opioid medications prescribed for MAT with the needs for post-Cesarean pain control? What are the implications for relapse of OUD after delivery?
Postpartum Care & Support	What are the risk factors for relapse after delivery? Do opioid type, dosing, and management strategies affect risk of relapse?
	Improve prenatal education and counseling about the benefits of breastfeeding and rooming-in after delivery. What interventions could increase breastfeeding initiation rates and prolong the duration of breastfeeding? What are the causal pathways between breastfeeding and the decreased occurrence and severity of NAS?
	What is the comparative effectiveness and safety of buprenorphine management strategies after delivery?
	How can we improve access, availability, acceptance, and affordability of long-acting reversible contraception? How to increase regular dual use of condoms and nonbarrier methods to prevent sexually transmitted infections?
	What are the clinical and psychosocial factors that correlate with the development of postpartum depression?

	What are the best tools for screening women with OUD for postpartum depression? What is the best frequency and timing of depression screening in prenatal and postpartum periods? Which pregnant women should be treated prophylactically to prevent postpartum depression?
Neonatal Screening & Assessment for NAS	What are the best methods for identification and screening for Neonatal Abstinence Syndrome? ▪ Need a validated biomarker for NAS as a physiologic state, for example, epinephrine or cortisol levels ▪ Need laboratory-on-a-chip method for rapid testing for NAS ▪ What are the predictive factors and thresholds for development of NAS? Are there any diagnostic assays to identify who will develop NAS and how they will respond to therapies?
	What are the best methods for assessing the development of neonates with NAS? What is the duration and frequency for observing neonates at risk for NAS? What factors define this period? → Develop objective tools using technology-assisted assessment for NAS diagnosis and severity → Perform individualized and comprehensive assessments to identify those neonates most susceptible to poor developmental outcomes → Test the different scoring systems and assessment protocols against each other
	What factors affect the NAS risk profiles for neonates? Different substance exposures may lead to the same symptoms; need ability to distinguish them to determine best therapy, accounting for population heterogeneity, type of drug, its dose and gestational age of exposure to maternal opioids
Treatment of NAS	What is the optimal initial drug for treatment of NAS?
	What are clinical or physiological indications for adding a second drug?
	Can genetic or epigenetic analyses be combined with antenatal exposures to tailor an optimal treatment regimen?
	How can we adjust NAS treatment for polydrug use during pregnancy?
	What are the clinical and social criteria for discharging NAS infants home with the mother or to other facilities?
	What criteria best select neonates and families for outpatient management?
	What resources are needed for safe and effective outpatient management?
Neonatal Discharge & Follow-up	What are the long-term development outcomes for children prenatally exposed to opioid agonist and/or antagonist medications? Note that: (a) Exposure is different based on variations in neonatal metabolism, (b) No published data on timing of opioid exposure and long-term developmental outcomes, (c) Role of the environment, maternal factors (age, health, education, insurance status), and social factors (household structure, neighborhood effects, chronic illness in family, mental health) is undefined, and (d) Latent effects of prenatal opioid exposure remain unknown.
	How do maternal psychiatric comorbidities and propensity for substance abuse affect child outcomes?
	What are the barriers to follow-up care related to state regulations?
	Do state-specific regulations affect screening, treatment, and neonatal outcomes?

In conclusion, long term funding for the studies referenced herein as well as the long-term care and treatment of these babies is essential to the resolution of this Crisis.

I certify under penalty of perjury that the foregoing is true and correct.

Executed on August 30, 2018.



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57. Baldacchino A, Arbuckle K, Petrie DJ, McCowan C. Erratum: neurobehavioral consequences of chronic intrauterine opioid exposure in infants and preschool children: a systematic review and meta-analysis. *BMC Psychiatry* 2015; **15**: 134.
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75. Konijnenberg C, Sarfi M, Melinder A. Mother-child interaction and cognitive development in children prenatally exposed to methadone or buprenorphine. *Early Hum Dev* 2016; **101**: 91-7.
76. Mactier H. Neonatal and longer term management following substance misuse in pregnancy. *Early Hum Dev* 2013; **89**(11): 887-92.
77. Nygaard E, Moe V, Slinning K, Walhovd KB. Longitudinal cognitive development of children born to mothers with opioid and polysubstance use. *Pediatr Res* 2015; **78**(3): 330-5.
78. Nygaard E, Slinning K, Moe V, Walhovd KB. Behavior and Attention Problems in Eight-Year-Old Children with Prenatal Opiate and Poly-Substance Exposure: A Longitudinal Study. *PLoS One* 2016; **11**(6): e0158054.
79. Nygaard E, Slinning K, Moe V, Walhovd KB. Cognitive function of youths born to mothers with opioid and poly-substance abuse problems during pregnancy. *Child Neuropsychol* 2017; **23**(2): 159-87.
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CURRICULUM VITAE

Kanwaljeet S. Anand

CONTENTS

8/29/2018

CURRICULUM VITAE

Name: **Kanwaljeet S. Anand**

Address: 770 Welch Road, #435, Palo Alto, CA 94304

Personal: Spouse: Itinder K. Anand
Children: Amrit K. Anand and Tejpartab S. Anand

Education:

1981	M.B.B.S.	Mahatma Gandhi Memorial Medical College, University of Indore, Indore, India.
1986	D.Phil.	Jesus College, University of Oxford, Oxford, U.K.
1991	F.A.A.P.	American Academy of Pediatrics, Elk Grove Village IL, USA
1997	F.R.C.P.C.H.	Royal College of Pediatrics and Child Health, London, U.K.
1998	F.C.C.M.	American College of Critical Care Medicine, Anaheim CA, USA.

Postdoctoral Training:

1980 - 1980	Intern, Maharaja Yeshwantrao Hospital, Indore, India
1980 - 1981	Intern, Hindu Rao Hospital, Delhi, India
1981 – 1982	House Officer, Department of Pediatrics, Maharaja Yeshwantrao Hospital, Indore, India
1982 - 1983	Senior House Officer, Special Care Baby Unit, Department of Paediatrics, John Radcliffe Hospital, Oxford, U.K.
1988 - 1991	Internship and Residency in Pediatrics, Department of Medicine, Children's Hospital, Boston, Massachusetts, U.S.A.
1991 – 1993	Clinical Fellow, Neonatal and Pediatric Intensive Care Units, Massachusetts General Hospital, Boston, Massachusetts, U.S.A.

Licensure and Certification:

1981	Registered Medical Practitioner, Madhya Pradesh Board, Bhopal, India.
1982	Limited Registration, General Medical Council, London, U.K.
1988	Massachusetts Board of Registration in Medicine, Boston, MA, (License No. 75047)
1991	Board Certification in Pediatrics, American Board of Pediatrics (valid 1991-1998)
1993	Composite State Board of Medical Examiners, Atlanta, GA (License No. 037123)
1993	Controlled Substance Registration, Drug Enforcement Administration, U.S. Department of Justice (License No: BA2998687, expires June 30, 2018)
1994	Board Certification, Sub-Board in Pediatric Critical Care, American Board of Pediatrics (Re-certified in 2004 and 2014, expires December 31, 2023)
1994	Basic Life Support (BLS Certification), American Heart Association (expires August, 2019)
1994	Pediatric Advanced Life Support (PALS Certification), American Heart Association (expires August, 2019)
1995	Advanced Cardiac Life Support (ACLS Certification), American Heart Association

(expires August, 2019)
1997 Arkansas State Medical Board, Little Rock, Arkansas (License No. E-1508)
2009 Board of Medical Examiners, Nashville, Tennessee (License No. MD045154)
2015 The Medical Board of California, Sacramento, CA (License No. C138692)
2016 Advanced Trauma Life Support, American College of Surgeons (No. 644546) (expires April 16, 2020).

Academic Appointments:

1983 - 1985	Rhodes Scholar and Research Fellow, University Department of Paediatrics, University of Oxford, Oxford, U.K.
1985 - 1988	Research Fellow in Anesthesia, Harvard Medical School, Boston, MA.
1988 - 1991	Clinical Fellow in Pediatrics, Harvard Medical School, Boston, MA.
1991 - 1993	Fellow in Pediatrics, Harvard Medical School, Harvard University, Boston, MA.
1993 - 1997	Assistant Professor of Pediatrics and Anesthesia, Emory University School of Medicine, Atlanta, GA.
1994 - 1997	Assistant Professor of Psychiatry and Behavioral Sciences, Emory University School of Medicine, Atlanta, GA.
1994 - 1997	Director for Critical Care Research, Department of Pediatrics, Emory University School of Medicine, Atlanta, GA.
1995 - 1996	Interim Director, Office for Research Promotion, Department of Pediatrics, Emory University School of Medicine, Atlanta, GA.
1997 - 2000	Associate Professor of Pediatrics and Anesthesiology, College of Medicine, University of Arkansas for Medical Sciences, Little Rock, Arkansas.
1997-2003	Section Chief, Critical Care Medicine, Department of Pediatrics, University of Arkansas for Medical Sciences, Little Rock, Arkansas.
1998 - 2000	Associate Professor of Anatomy & Neurobiology, College of Medicine, University of Arkansas for Medical Sciences, Little Rock, Arkansas.
2001-2009	Professor of Pediatrics, Anesthesiology, Pharmacology, Neurobiology & Developmental Sciences, College of Medicine, University of Arkansas for Medical Sciences, Little Rock, Arkansas.
2001-2009	Morris & Hettie Oakley Endowed Chair for Critical Care Medicine, University of Arkansas for Medical Sciences, Little Rock, Arkansas.
2009-2014	St. Jude Chair for Excellence in Critical Care Medicine; St. Jude Children's Research Hospital, Memphis, TN.
2009-2015	Professor of Pediatrics, Anesthesiology, Anatomy & Neurobiology, Principal Investigator, UT Neuroscience Institute, University of Tennessee Health Science Center, Memphis, TN.
2015-2016	Division Chief, Pediatric Critical Care Medicine, Department of Pediatrics, Stanford University School of Medicine, Palo Alto, CA.
2015-present	Professor of Pediatrics, Anesthesiology, Perioperative & Pain Medicine, Stanford University School of Medicine, Palo Alto, CA.

Professional Awards

1982-1985 Rhodes Scholarships for India, University of Oxford, U.K.
1986 ***Dr. Michael Blacow Award*** for the Best Paper presented at the 58th Annual

Meeting of the British Paediatric Association, York, U.K.

1989 The ***Von L. Meyer Award for Research*** at Children's Hospital, Boston.

1992 ***Pediatric Resident Research Award***, American Academy of Pediatrics

1994 Inaugural recipient, ***Young Investigator Award in Pediatric Pain***, International Association for the Study of Pain, Special Interest Group for Pain in Children, Philadelphia, PA.

1995 6th Annual ***Dr. Fred J. Vlazny Humanitarian Award*** and Visiting Professorship, Medical College of Wisconsin, Milwaukee WI.

2000 ***Jeffrey Lawson Award for Advocacy in Children's Pain Relief***, 19th Annual Scientific Meeting, American Pain Society

2001 Inaugural Recipient, ***Morris & Hettie Oakley Endowed Chair for Critical Care Medicine***, University of Arkansas for Medical Sciences and Arkansas Children's Hospital, April 13th, 2001.

2007 The ***Father Joseph Biltz Award*** from JCCA (formerly the NCCJ of Arkansas) for promoting inter-faith harmony in Central Arkansas.

2007 ***Joan M. Cranmer "Mentor of the Year" Award***, Department of Pediatrics, University of Arkansas for Medical Sciences.

2008 ***"Salute to Greatness" Individual Award*** from the Dr. Martin Luther King Commission, State of Arkansas, January 18th, 2008.

2006-2008 **Vice-Chair and Chair of the Research Committee**, Society of Critical Care Medicine

2009 ***The Nils Rosén von Rosenstein Award***, an international award given to Pediatricians every 5 years by the Swedish Society of Medicine & Swedish Paediatric Society, April 23, 2009.

2010 Inaugural recipient, *The* ***St. Jude Chair of Pediatric Critical Care Medicine***, University of Tennessee Health Science Center and St. Jude Children's Research Hospital, March 31st, 2010.

2011 ***Mentor Award***, School of Graduate Studies, University of Arkansas for Medical Sciences, July 2011.

2013 9th Annual ***"In Praise of Medicine Award"***, Erasmus University Centenary Celebration, Faculty of Medicine, Rotterdam, The Netherlands; October 4, 2013.

2015 ***Journées Nationales de Néonatologie,*** Keynote Address at The Pasteur Institute, Paris, France; March 26th, 2015.

2015 ***Respect for Nursing Award*** from the PICU Nurses and Nursing Leadership, Lucile Packard Children's Hospital, Palo Alto, CA.

2016 ***Nightingale Excellence Award***, the only physician who has received this honor by Stanford Children's Healthcare and Lucile Packard Children's Hospital, Stanford University, Palo Alto, CA; October 25th, 2016.

Honors and Professional Recognition:

1968-1974 Merit Certificates, The Daly College, Indore, India

1975 M.P. State Science Talent Scholarship, Madhya Pradesh, India

1977-1978 Merit Students Scholarship, University of Indore, India

1977 University Gold Medal for Anatomy, University of Indore, India

1987 Listed in ***American Men and Women in Science***

1988 Honorary Life Membership in the National Neonatology Forum, India.

1989 Keynote Address: First European Conference on Pediatric Pain, June 1989,

Maastricht, The Netherlands

1990 Keynote Address: 44th Annual Congress, Svensk Forening for Anesteshioch Intensivvard, Huddinge, Sweden.

1990 Keynote Address: 4th Annual John Lind Symposium, Trollhattan, Sweden.

1991 Who's Who Among Rising Young Americans, Citation Directories, USA.

1992 Men of Distinction, Cambridge University Press, Cambridge, U.K.

1993 International ***Who's Who in Medicine***

1993 International Scientific Committee, 3rd International Meeting of Pediatric Intensive Care, Padova, Italy.

1993 Scientific Planning Committee, Symposium on Pain and Stress in the Newborn, National Institute of Child Health and Human Development.

1994 Co-Chair, NICHD Symposium on "Neonatal Pain: Physiology and Management", June 1994, Philadelphia PA, U.S.A.

1995 Moderator for Maternal and Newborn Health Symposium in Child Health 2000, 2nd World Congress & Exposition, May 30 - June 3, 1995, Vancouver, Canada

1995 Keynote Address: Nordic Congress on Children and Pain, September 7-9 1995, Stockholm, Sweden.

1995 Keynote Address: XVII Annual Congress of the Dutch Paediatric Association, November 1, 1995, Veldhoven, The Netherlands.

1996 International Scientific Committee, 2nd World Congress on Pediatric Intensive Care, June 1996, Rotterdam, The Netherlands.

1996 Plenary Lecturer in Pediatric Pain, 8th World Congress on Pain, International Association for the Study of Pain, August 17-22 1996, Vancouver (B.C.).

1997 International Scientific Advisory Committee, 4th International Symposium on Pediatric Pain, International Association for the Study of Pain, Helsinki, Finland.

1997 Member of the U.S. Rhodes Scholars Selection Committee, State of Arkansas.

1997 Member, International Selection Committee for the 2nd Young Investigator Award for Pediatric Pain, Special Interest Group on Pediatric Pain, International Association for the Study of Pain.

1997 Elected to Fellowship, Royal College of Paediatrics & Child Health, U.K.

1998 Elected to Fellowship of the American College of Critical Care Medicine.

1998 Listed in Marquis' *Who's Who in Science and Technology*

1999 Chairman, 2nd International Consensus Conference on Guidelines for Procedural Pain Management in Infants, August 21, 1999; Baden, Austria.

1999 Keynote Address : International Symposium on "Basic Mechanisms and Recent Advances in Pediatric Pain", German Pediatric Association, University of Erlangen, Kloster Weltenberg, Germany, October 29-31, 1999.

1999 Keynote Address: IIIrd Congreso Internacional De Clinica Del Dolor Y Cuidados Paliativos, Asociacion Mexicana De Algologia A.C., Ciudad y Puerto de Veracruz, Veracruz, México, October 31st to November 2nd, 1999.

1999 Keynote Address: Fifth Greater Tulsa Area Pain Conference, University of Oklahoma, Tulsa OK, October 1, 1999.

1999 Plenary Podium Presentation: 52nd Annual Meeting, American Academy of Pediatrics, Washington DC, October 9th to 15th, 1999.

1999 Member, Board of Directors, Arkansas Children's Hospital Research Institute

2000 Keynote Address: International Symposium on Infant Pain, Karolinska

Institute, Stockholm, Jan 25th, 2000.

2000 Keynote Address: Danish Pediatric Society, University Hospital of Copenhagen, Denmark, Jan 21st, 2000.

2000 Keynote Speaker: "Pain in Children: Conquering the Hurt", The Hospital for Sick Children, Pain Awareness Week, Toronto, March 31st, 2000.

2000 Co-Chair, Pharmacology, Pain & Sedation Track, 3rd World Congress of Pediatric Intensive Care, Montreal, Canada, June 24-29, 2000.

2000 Plenary Lecture, 5th International Symposium on Pediatric Pain, Special Interest Group for Pain in Children, International Association for the Study of Pain, London, U.K., June 19th, 2000.

2000 Public Lecture, The European Institute of Health and Medical Sciences at the University of Surrey, Chertsey, Surrey, U.K.; June 21st, 2000.

2000 Plenary Speaker, 3rd World Congress on Pediatric Intensive Care, Montreal, Canada; June 26th-29th, 2000.

2000 ***Baxter Plenary Speaker***, 6th Annual Meeting of the Society for Pediatric Anesthesia, Sanibel, FL.

2001 Keynote Address: 10th Annual Symposium on Neonatal-Perinatal Medicine, University of Michigan, Ann Arbor, MI; April 26th, 2001.

2001 Listed in ***Strathmore's Who's Who***, 2001-2002 Edition

2001 Plenary Presentation, 14th Annual Meeting of the Canadian Pain Society, Montreal, Canada, May 10th, 2001.

2001 Keynote Speaker, 3rd Nordic Congress on Pain in Children, Stockholm, Sweden, Sept 12th, 2001.

2002 Honorary Secretary, U.S. Rhodes Scholarships Selection Committee, State of Arkansas

2002 Steering Committee Member, National Summit on Race 2002, Little Rock

2002 Editorial Board, *Critical Care Medicine,* Williams & Wilkins Publishers

2002 Editorial Board, *Biology of the Neonate,* Karger A.G. Publishers

2002 Pfizer Visiting Professorship in Pain Medicine, Department of Pediatrics, Wayne State University and Detroit Children's Hospital, Detroit, MI, June 3-6, 2002.

2002 Member of the National Planning Group, NICHD/FDA Newborn Drug Development Initiative

2002 Plenary Speaker, 18th European Congress of Perinatal Medicine, June 19 – 22, 2002, Oslo, Norway.

2002 Keynote Speaker, 28Th Annual Congress, German Society of Neonatology and Pediatric Intensive Care, June 27 – 29, 2002, Mainz, Germany.

2002 Keynote Speaker, 4th International Forum on Pediatric Pain, September 19 - 22, 2002, White Point Beach, Nova Scotia, Canada.

2002 Keynote Speaker, International IPOKRaTES Seminar on "Neonatal Comfort and Care" Oct 10-12, 2002, Gmunden, Austria.

2002 ***Lesley Cooper Memorial Lecture***, 20th Neonatal Course for Senior Paediatricians, Imperial College of Medicine, November 25-29, 2002, London, England.

2003 Member of the Research Committee, Society of Critical Care Medicine.

2003 Pfizer Visiting Professorship in Pain Medicine, Department of Pediatrics, Baylor University and Texas Children's Hospital, Houston TX, Feb 19-21, 2003.

2003	***Arnold J. Rudolph Memorial Grand Rounds***, Department of Pediatrics, Baylor University and Texas Children's Hospital, Houston, TX.
2003	***Chairman, Neonatal Pain Task Force***, FDA/NICHD Newborn Drug Development Initiative
2003	Keynote Address, Opening Ceremony of the EURAIBI (Europe Against Infant Brain Injury) Congress, June 6, 2003, Siena, Italy (live broadcast of opening ceremony to 125 countries by Reuters International).
2003	***Chairman, Pharmacology, Analgesia & Sedation Track***, 4th World Congress on Pediatric Intensive Care, Boston MA, June 16-20, 2003.
2003	Listed in ***Who's Who in America***, 58th Edition, Marquis Who's Who, Inc.
2003	Member, Pediatric Pharmacology Research Study Section (ZHD1 DSR-A-01), National Institute for Child Health and Human Development
2003	Keynote Address: Annual Meeting of the Perinatal Research Society, Charleston SC, September 12-14, 2003.
2003	Member, Pediatrics Subcommittee Study Section (ZHD1 CHHD-A-01), National Institute for Child Health and Human Development
2004	***Windermere Honorary Lecturer*** (presented to Her Royal Highness Princess Anne), 8th Spring Meeting, Royal College of Paediatrics and Child Health, York (UK).
2004	Expert Witness, U.S. Supreme Court, Department of Justice for the Partial-Birth Abortion Ban Act of 2003, April 6th, 13th and 15th, 2004.
2004	Keynote Speaker, 4th Nordic Congress on Children and Pain, Linköping, Sweden; May 5-7, 2004.
2004	Member, Loan Repayment Program Study Section (ZHD1 DSR-A LRP), National Institute for Child Health and Human Development.
2004	Keynote Speaker, 10th International Postgraduate Course in Neonatal Intensive Care, Buenos Aires, May 17-19, 2004.
2004	***Laurie Edmunds Keynote Speaker***, University of Massachusetts Medical School, June 2, 2004, Marlboro, MA.
2004	International Editorial Board, ***Anestesia Pediatrica e Neonatale*** (Pediatric and Neonatal Anesthesia)
2004	Elected to membership of the ***American Pediatric Society***
2005	Listed in ***Who's Who in America***, 2005 (59th Edition), Marquis' Who's Who, Inc.
2005	Editorial Board, ***Pain,*** official journal of the International Association for the Study of Pain.
2005	John S. Liebeskind Visiting Professorship, Departments of Pediatrics, Medicine, Psychology, History, Sociology, Anthropology, University of California at Los Angelis, April 29th, 2005.
2005	***"World News Tonight" for ABC News*** Interviewed for the latest research on pain in infants and children, May 10th, 2005.
2005-2006	**Vice-Chair, Research Committee, Society of Critical Care Medicine.**
2005	Faculty Advisor, Graduate School of Studies, University of Arkansas for Medical Sciences
2005	VIP Member, *Continental Who's Who* registry of National Business Leaders.
2005	Arkansas Hospital Association, Judges' Merit Award in Advertising (3rd place in the Special Visuals Category for Dr. Martin Luther King Day lecture).
2005	Expert Witness testimony in relation to the **Unborn Child Pain Awareness**